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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

#### [0001]

[Field of the Invention]In an electric motor with few numbers of turns, this invention relates to the connection disposal method of a rectangular wire and a coil end which forms the coil of an electric motor like the electric motor of a low voltage battery drive.

#### [0002]

[Description of the Prior Art]In the conventional electric motor, the method of coiling around teeth directly copper wire round as conductive winding which forms a coil as a method of giving winding to teeth, and the method of inserting copper wire in the inside of a slot from slot opening at the 2nd process, after coiling copper wire around a winding frame at the 1st process are known.

[0003]At this time, in order to finish a coil end size as small as possible, copper wire needed to be coiled in line.

[0004]As an electric motor using a rectangular wire, JP,H9-247882,A is known and the electric motor of composition of having electrically connected the end part (it corresponds to "the start end of a coil volume" in Description of this application) and field magnetic pole (it corresponds to the "teeth" in Description of this application) of the straight angle conductor is indicated.

#### [0005]

[Problem(s) to be Solved by the Invention]If the cross-section area of conductive winding is below a 2 mm<sup>2</sup> grade, the tip part of a lead and conductive winding is twisted mutually, and connecting with soldering etc. is possible and, generally it carries out. However, it drives with the power supply not more than 50V, and in the electric motor which sends the current more than 50A through winding, and is made to generate torque, since the cross-section area of a lead and conductive winding will become a 10 mm<sup>2</sup> grade respectively if the maximum output is taken into consideration, if they are doubled, it will become a terminal area of at least 20 mm<sup>2</sup>. In the case of the star of a three phase circuit, especially the terminal area of a neutral point will be at least 30 mm<sup>2</sup>. The terminal area of the lead of a high current type electric motor, conductive winding, and a neutral point is thick, and since it is hard, it is dramatically difficult to secure electric and the mechanical reliability of a terminal area by the construction method which solders by twisting.

[0006]In order to make the cross-section area of conductive winding thick in the case of an electric motor which sends a high current, Conductive winding does not pass along a nozzle in regular slot opening, or. Since an insulating film is exfoliated at the time of conducts connection with a lead, and neutral point connection processing in order to make copper wire into multi-this \*\*\*\*, after the man day was needed or inserting in the inside of a slot, the coil end became large and SUBJECT, like a forming cycle is needed occurred. In order to secure especially stator inside diameter accuracy or to prevent the increase in a loss by stator-core division, winding was difficult when considering it as non division for every stator teeth.

[0007]If the electrical link of each coil is performed via a magnetic steel sheet with high electrical resistance as compared with copper, when 50v of voltage which causes [ of an electric motor ] degradation and is built between the terminals of a coil like this invention will be low voltages as follows, the influence increases.

[0008]This invention is invented in view of such SUBJECT, and is a thing.

The purpose is to provide the high-output and efficient electric motor which can perform winding

easily even if the cross-section area of \*\* becomes large, and can finish a coil end size small.

[0009]

[Means for Solving the Problem]In order to solve this SUBJECT, this invention via an insulating material to a rotator and a teeth part of a stator core, The tip carries out multiple-times passage of the slot end by the side of a top panel of said stator core, and the bottom for a rectangular wire, A stator connected using a body or a conductive plate which formed a coil wound one layer to a diameter direction depth direction of a slot, and formed each coil in the end constitutes an electric motor.

[0010]By the above-mentioned means, a small, high-output, and efficient electric motor which made a coil end small can be provided.

[0011]

[Embodiment of the Invention]The invention of this invention according to claim 1 via an insulating material to a rotator and the teeth part of a stator core, The tip carries out multiple-times passage of the slot end by the side of the top panel of said stator core, and the bottom for a rectangular wire, It is the electric motor being constituted by the stator in which the coil wound one layer to the diameter direction depth direction of a slot was formed, and when carrying out winding, it has the operation that the position stability inside a slot can be received.

[0012]The invention according to claim 2 has the operation that the length of the long side of the section of a rectangular wire is the electric motor according to claim 1 which is more than half of the diameter direction depth as for less than the diameter direction depth of a slot, and can control volume collapse of a rectangular wire.

[0013]The shorter side of the section of a rectangular wire is the electric motor according to claim 1 or 2 which is the 1/5 or less length of a long side, and the invention according to claim 3 has the operation that the increase in the substantial wirewound resistor by a skin effect can be controlled, even if especially a carrier frequency becomes high to 20 kHz.

[0014]The invention according to claim 4 has the small length of the long side of the section of a rectangular wire the start of a volume, It is an electric motor given in any 1 paragraph of Claim 1 to Claim 3 which becomes large gradually as it approaches in the end of a volume, and in order to coil the rectangular wire set by slot shape, it has the operation that a slot cross-section area can be used effectively.

[0015]The section of a rectangular wire is the electric motor according to claim 1 which is an approximately trapezoid which becomes broad gradually toward the diameter direction depth direction of a slot, and the invention according to claim 5 has the operation that a slot cross-section area can be used effectively.

[0016]The invention according to claim 6 forms a body in an end at volume the beginning of the rectangular wire which forms a coil, It is an electric motor given in any 1 paragraph of Claim 1 closing the line which connects the lead end of line or neutral points to said body to Claim 5, and has the operation that it can connect easily without using a lead or the coupling parts of exclusive use [ neutral point connection ].

[0017]The invention according to claim 7 is the electric motor according to claim 6 providing an insulating material between the body (after a caulking) and stator core which were formed in the end at volume the beginning of the rectangular wire which forms a coil, and has the operation that the insulation with a body and a stator core can be ensured.

[0018]The invention according to claim 8 uses as an insulator the insulation of a coil end and stator core including the body (after a caulking) formed in the end at volume the beginning of the rectangular wire which forms a coil, It is an electric motor given in any 1 paragraph of Claim 1 providing the crevice which stores said body to said insulator to Claim 7, and it has the operation that the insulation with a body and a stator core can be ensured, without enlarging a coil end size.

[0019]The body formed in the end at volume the beginning of the rectangular wire in which the invention according to claim 9 forms a coil (after a caulking), Or since it is Claim 7 providing the level difference which stores the insulator which stored said body in a stator core, or the electric motor according to claim 8 and a body can be dedicated to a position lower than a stator core top panel part, It has the operation that a coil end size can be made smaller.

[0020]The invention according to claim 10 forms a body in the volume finish end part of the rectangular wire which forms a coil, It is an electric motor given in any 1 paragraph of Claim 1

closing the line which connects neutral points or the lead end of line to said body to Claim 9, and has the operation that a neutral point or lead connection can be connected easily without using special parts.

[0021]It is a manufacturing method of Claim 6, wherein the body of a volume start [ of the rectangular wire in which the invention according to claim 11 forms a coil ] or start [ of a volume ], and volume finish end part is formed before winding to the electric motor according to claim 10, It is not necessary to form a body in a \*\* space, and has the operation that a body can be easily formed in the large (regardless of the inside and outside of a slot) space in front of winding.

[0022]The invention according to claim 12 inserts in one electric wire for neutral point connection the body and insulating tube which were formed in the volume finish end part of the rectangular wire which forms a coil in neutral point connection, It is an electric motor given in any 1 paragraph of Claim 6 covering the electric wire for neutral point connection except a caulking part to Claim 10, and has the operation that neutral point connection can be made in a \*\* space.

[0023]When three-phase-circuit connection of the coil is made and the invention according to claim 13 makes the number in the volume start of said coil, or the end of a volume a 3n piece, It is an electric motor given in any 1 paragraph of Claim 1 which connected the part or the end part of a volume with the conductive plate at volume the beginning of every [ n coils (n is two or more integers) in phase ] to Claim 5, and has the operation that it can connect easily without using a lead or the coupling parts of exclusive use [ neutral point connection ].

[0024]When it is considered as the n number in the volume start of a coil, or the end of a volume, the invention according to claim 14 is an electric motor given in any 1 paragraph of Claim 1 which connected the volume start of n pieces, or the end of a volume with the conductive plate to Claim 5, and has the operation that neutral point connection can be made by small part mark.

[0025]It is Claim 13, wherein the invention according to claim 15 uses a conductive plate as copper and a copper alloy (it is only hereafter indicated as "copper"), or the electric motor according to claim 14, and has the operation that joule loss can be controlled.

[0026]It is an electric motor given in any 1 paragraph of Claim 13 securing the invention according to claim 16 by the insulating means which provided the electric insulation between conductive plates in said conductive plate surface to Claim 15, It has the operation that the insulation between the power supplying part of a coil and a neutral point is easily securable.

[0027]The invention according to claim 17 is the electric motor according to claim 16 which provided an insulation sheet, an electric insulating plate, a resin-molding article, or insulating film processing as an insulating means, and has the operation that the insulation between the power supplying part of conductive winding and a neutral point is certainly securable.

[0028]It is an electric motor given in any 1 paragraph of Claim 13, wherein the invention according to claim 18 uses said conductive plate as a power supply receipt means to Claim 17, Since a lead becomes unnecessary, part mark and a working manhour can be reduced, and it has the operation that a coil end can be made small.

[0029]It is an electric motor given in any 1 paragraph of Claim 10 and Claim 12 to Claim 18 from Claim 1, wherein the invention according to claim 19 is divided into the stator core piece in which the stator core is formed of at least one teeth and yoke, It has the operation that winding nature can be raised.

[0030]From Claim 1 whose cross-section area of a rectangular wire is more than 5 mm<sup>2</sup>, in any 1 paragraph of Claim 10 and Claim 12 to Claim 19, the invention according to claim 20 is an electric motor of a description, and has the operation that the increase in the substantial wirewound resistor especially by a skin effect can be controlled.

[0031]Both the inventions according to claim 21 are electric motors given in any 1 paragraph of Claim 10 and Claim 12 to Claim 20 from Claim 1 which drives the battery which moves as a power supply, and have the operation that it is small as an electric motor for low voltages, and power consumption can be made small.

[0032]The voltage which requires the current which flows into the coil of an electric motor between more than 50A or the terminal of a coil is an electric motor given in any 1 paragraph of Claim 10 and Claim 12 to Claim 21 from Claim 1 which is less than 50V, and the invention according to claim 22 has the operation that high power can be obtained.

[0033]From Claim 1, the invention according to claim 23 is a compressor which carries the electric motor of a description in any 1 paragraph of Claim 22 from Claim 10 and Claim 12, and has the operation that the compressor whose efficiency of energy use it is small and is high can be obtained.

[0034]The invention according to claim 24 is a car air-conditioner carrying the compressor according to claim 23, and has the operation that it is small and the small car air-conditioner of power consumption can be obtained.

[0035]From Claim 1, the invention according to claim 25 is a car actuator which carries the electric motor of a description in any 1 paragraph of Claim 22 from Claim 10 and Claim 12, and has the operation that the car actuator whose efficiency it is small and is high can be obtained.

[0036]

[Example]Hereafter, the example of this invention is explained with reference to Drawings.

[0037](Working example 1) Drawing 1 is a top view of the electric motor in one working example of this invention.

[0038]As shown in drawing 1, the stator 11 has the slot 13 of the same number which carries out an opening to the six teeth 12 in shaft orientations, and the rectangular wire 15 is directly wound via the insulating material 14. These rectangular wires 15 are carried out in the three-phase-circuit star. A section is a rectangle long to the diameter direction depth direction of a slot, are winding one layer of rectangular wires 15 to the diameter direction depth direction of a slot here, and the tip of the rectangular wire 15 carries out multiple-times passage of the slot end by the side of the top panel of the stator 11, and the bottom, Since the winding coil was formed in the teeth 12 for the rectangular wire 15, when carrying out winding, the position stability inside a slot can provide the good good electric motor of workability. The section of the rectangular wire 15 may provide a fillet in the corner instead of an exact rectangle here, and the coat of other conductive winding can be prevented from getting damaged by the corner of conductive winding during winding operation.

[0039]Although this stator core 17 laminates the stator core sheet (not shown) which pierces a magnetic steel sheet, a stator core sheet is non division. In the use asked especially for high velocity revolutions, such as a car air-conditioner, since it becomes a high carrier frequency, if a stator core sheet is divided for every teeth, a loss will increase. When making an air gap small, noise also becomes [ gap accuracy ] better [ the non division ] small. Although winding is difficult in a nozzle winding method at this time, good productivity and a regular winding line are realizable by adopting the above-mentioned tuck method.

[0040]The length of the long side of the section of the rectangular wire 15 should just be less than the length of the diameter direction depth direction of the slot 13, if more than half of the length of the diameter direction depth direction of the slot 13 is desirably, it does not have volume collapse, can make the coil end size after winding small, and can provide a small and lightweight electric motor. A coil end is a part of coil formed in the stator core both-ends side side.

[0041]The length of the shorter side of the section of the rectangular wire 15 is set as the 1/5 or less length of a long side. Even if, especially as for this, a carrier frequency becomes high to about 20 kHz, there is no increase in the substantial wirewound resistor by a skin effect, and the loss by Joulian heat can be reduced. For example, when the conductor of a strand is copper in 10 kHz, a carrier frequency, Since it becomes frequency  $f=10 \times 10^3$  (Hz) amplitude permeability  $\mu=\mu_0=4\pi \times 10^{-7}$  (H/m) and conductivity  $k=5.8 \times 10^7$  (S/m) and the invasion length in consideration of a skin effect of current becomes  $\{1/\sqrt{\mu_0 \mu k f}\}$ , The conductive winding of the thickness not more than  $1/\sqrt{\mu_0 \mu k f}$   $x_2=1.32$  mm is required. For example, if the cross-section area of 5.7 mm<sup>2</sup> is necessary, it is good for the length of 0.95 mm and a long side to be the length of a shorter side about 6 mm.

[0042](Working example 2) Drawing 2 is a top view of the electric motor in one working example of this invention.

[0043]As shown in drawing 2, it is the stator 21 which gave the rectangular wire 25 directly to said teeth part 22 of the stator core 27 with two or more slots 23 which counter and carry out an opening to a rotator (not shown), two or more teeth 22, and said rotator via the insulating material 24, and the section of said rectangular wire 25 is an approximately trapezoid. It is characterized by becoming broad gradually toward the diameter direction depth direction of

a slot, and the tip of the rectangular wire 25 carries out multiple-times passage of the slot end by the side of the top panel of the stator core 27, and the bottom, and forms the winding coil in the teeth 22 for the rectangular wire 25.

Usually, slot shape becomes broad toward a diameter direction depth direction. Therefore, it is set as the width in alignment with the diameter direction periphery of the slot 23 provided in the stator core 27, when it winds around teeth, a slot cross-section area can be used effectively, and a slot lamination factor can be raised. About an operation and effect of a tuck method, it is the same as that of working example 1.

[0044](Working example 3) Drawing 3 is a top view of the electric motor in one working example of this invention.

[0045]As shown in drawing 3, are the stator 31 which gave the rectangular wire 35 directly to said teeth part 32 of the stator core 37 with two or more slots 33 which counter and carry out an opening to a rotator (not shown), two or more teeth 32, and said rotator via the insulating material 34, and the length of the long side of the section of the rectangular wire 35, It is characterized by becoming large gradually, and the tip of the rectangular wire 35 carries out multiple-times passage of the slot end by the side of the top panel of the stator core 37, and the bottom, and forms the winding coil in the teeth 32 for the rectangular wire 35 as it is small the start of a volume and approaches in the end of a volume. Usually, the diameter direction depth is as small as a same direction end part, and the center section of slot shape is large. Therefore, it is set as the uniform cross-section area by the width which met the shape of the slot 33 provided in the stator core 37, when it winds around teeth, a slot cross-section area can be used effectively, and a slot lamination factor can be raised. It is good to operate orthopedically so that it may become a predetermined cross-section area beforehand, and to wind the length of the rectangular wire 35 wound around one teeth at this time. About an operation and effect of a tuck method, it is the same as that of working example 1.

[0046](Working example 4) Drawing 4 is a perspective view of the end of a rectangular wire, and lead wire connection which forms the coil in one working example of this invention. As shown in drawing 4, beforehand, only the inside carries out insulating exfoliation, and is processed into cylindrical shape at least, and the volume first body 16 of the rectangular wire 15 can enable connection stable mechanically and electrically by closing the end of the lead 41 to the body 16. Similarly, beforehand, only the inside carries out insulating exfoliation at least, and the body in the volume end of the rectangular wire 15 (not shown) has formed the body.

[0047]The part mark and the working manhour of a terminal area with the lead 41 and a neutral point terminal area (drawing 6 explains) are reducible. Here, it may close so that a start [ of a volume ] and volume finish end part may insert a lead end-of-line part by turning up even if it does not process it cylindrical.

[0048]When it is not necessary to explain and the start of a volume is connected with a lead, the end of a volume is connection of a neutral point.

[0049]Drawing 5 is the perspective view of the axial end of a body, an insulator, and a stator core formed in the end at volume the beginning of the rectangular wire in one working example of this invention which forms a coil. As shown in drawing 5, the insulator 53 with which the body 16 formed in the shaft-orientations top panel part of the stator core 51 at volume the beginning of the rectangular wire 15 at the end and the stator core 51 are insulated was formed, and the crevice which stores the body 16 to the insulator 53 was provided. The insulation reliability of the body 16 can be improved by forming the insulator 53.

[0050]And the level difference 52 which stores the insulator 53 which stored the body 16 was formed in the shaft-orientations top panel part of the teeth part 54 of the stator core 51. Since the insulator 53 is beforehand installed in the shaft-orientations top panel part of the stator core 51 and the body 16 can be dedicated to a position lower than the upper face part of the stator core 51, the small electric motor which made the coil end size small can be provided.

[0051]It is characterized by processing the body in the volume end of the rectangular wire 15 (not shown), or the body 16 formed in the end at the beginning of a volume before winding, and since it is not necessary to perform connection processing in a narrow space after forming a coil, a winding man hour is reducible.

[0052]Drawing 6 is the perspective view of the electric wire for connection of a body and neutral points formed in the volume finish end part of the rectangular wire in one working example of this invention. As shown in drawing 6, the body 63 is formed in the volume finish end part of the

rectangular wire 62, the body 63 is inserted in the electric wire 61 for neutral point connection for connection, and connection of neutral points is made by caulking \*\*\*\*\*. The number of the electric wires 61 for neutral point connection is one, and they are made to go away with the body 63, and are covered with the insulating tube except for the portion. As for the electric wire 61 for neutral point connection, insulating coating is removed selectively only the number and the same number of the neutral point. Since a large space is not needed when carrying out connection processing with the body 63 and the electric wire 61 for neutral point connection, the small electric motor which made the coil end size small can be provided.

[0053]It may join cylindrical and a stator may be formed, after coiling the rectangular wire 15 around two or more divided teeth 54 beforehand, when there is a special Reason over which priority is given to the superiors for lamination factors and winding nature. In this case, since it is not necessary to perform winding operation, making slot 55 narrow inside pass the rectangular wire 15, a winding man hour is reducible.

[0054](Working example 5) Drawing 7 is an end connection processing perspective view of the coil in one working example of this invention.

[0055]They are a figure in which drawing 7 (a) shows the conductive plates 73 and 76, and the figure with which (b) piled up the conductive plates 73 and 76, and made them in one. (c) is the figure which made the stator which wound the coil 71 equip with the conductive plates 73 and 76 which are shown in (b), and which were made in superposition one. Only the hole required in order to penetrate the end part 75 of a volume is shown in the hole required for the conductive plate 73 shown in (a) in order to make the part 72 penetrate at volume the beginning of the class coil 71, and the conductive plate 76 (in practice, as shown in (b)). In addition, the hole which makes the part 72 and the end part 75 of a volume penetrate at the beginning of a volume is provided, and the part 72 and the end part 75 of a volume are insulated electrically at these holes and the beginning of another volume.

[0056]As shown in drawing 7, when three-phase-circuit connection of the coil 71 is made and the number of the part 72 or the end part 75 of a volume is made into a 3n piece (n is two or more integers) at volume the beginning of the coil 71, The part 72 or the end part 75 of a volume was connected with the conductive plate 73 at volume the beginning of every [ coil 71 / n pieces / (n is two or more integers) in phase ]. After winding a rectangular wire around teeth as mentioned above, the part 72 is connected electrically and mechanically with the conductive plate 73 in which the insulating means 74 was formed at volume the beginning of each coil 71. Since it is not necessary to connect a lead if it carries out like this, part mark and a connection working manhour can be reduced, and a cheap and small electric motor can be provided.

[0057]When it is considered as the n number of the part 72 at the end part 75 of a volume of the coil 71, or the beginning of a volume, it is characterized by connecting the part 72 with the conductive plate 76 at the n end parts 75 of a volume, or the beginning of a volume, and neutral point connection can be made by small part mark. As a result, a connection working manhour can be reduced and a cheap and small electric motor can be provided.

[0058]If a copper material is used for the conductive plates 73 and 76, the electric motor which is small and has little joule loss can be provided. The insulating means was given to the surface of the conductive plates 73 and 76, and between [ two or more ] conductive plate 73 and the insulation of the conductive plates 73 and 76 are secured. As the insulating means 74, what is necessary is just to have provided an insulation sheet, an electric insulating plate, a resin-molding article, or insulating film processing, the insulation reliability between the part 72 and the end part 75 of a volume can be improved at volume the beginning of the coil 71, for example, and an electric motor with high safety can be provided by low cost.

[0059]By using the part 72 as a power supply receipt means to an electric motor at volume the beginning of said conductive plate 73 and conductive winding, since a lead becomes unnecessary, part mark and a working manhour can be reduced, and the small and cheap electric motor which made the coil end small can be provided. The cross-section area of said coil 71 is a rectangular wire more than 5 mm<sup>2</sup>, and since the length of the shorter side of a section is set as the 1/5 or less length of a long side, it can control the increase in the substantial wirewound resistor especially by a skin effect.

[0060]This electric motor drives [ both ] the battery which moves as a power supply, the voltage which requires the current which flows into the coil 71 between more than 50A or the terminal of the coil 71 is less than 50V, and, in more than 2500w, the maximum output can enable large-

sized air conditioning of the car interior of a room with \*\*\*\* and little [ that it is small and ] power consumption. It is a compressor carrying this electric motor, and the compressor whose efficiency of energy use it is small and is high can be provided. It is a car air-conditioner carrying this electric motor, and it is small and the small car air-conditioner of power consumption can be provided. It is a car actuator which furthermore carries this electric motor, and it is cheap and the car actuator whose efficiency it is small and is high can be supplied. In this example, although the thing using the permanent magnet as a rotor is assumed using a three-phase-circuit star, even if it is polyphases other than single phase or a three phase circuit, it is the same.

[0061]

[Effect of the Invention]As mentioned above, according to the invention of this invention according to claim 1, also in a rectangular wire with a big cross-section area, it can wind easily, and the high-output and efficient electric motor which can finish a coil end size small can be provided.

[0062]According to the invention according to claim 2, there is no volume collapse and the small and lightweight electric motor which can make the coil end size after winding small can be provided.

[0063]According to the invention according to claim 3, even if especially a carrier frequency becomes high to 20 kHz, the increase in the substantial wirewound resistor by a skin effect can be controlled, and a high-output and efficient electric motor can be provided.

[0064]According to the invention according to claim 4, since the rectangular wire set by slot shape is coiled, a slot cross-section area can be used effectively and a high-output and efficient electric motor with a high lamination factor can be provided.

[0065]According to the invention according to claim 5, a slot cross-section area can be used effectively and a high-output and efficient electric motor with a high lamination factor can be provided.

[0066]According to Claim 6 and the invention according to claim 10, the electric motor which can connect lead connection or a neutral point easily by small part mark without using special parts can be provided.

[0067]According to the invention according to claim 7, an electric motor with high insulation reliability can be provided.

[0068]According to Claim 8 and the invention according to claim 9, the electric motor which made the coil end size small can be provided.

[0069]According to Claim 11 and the invention according to claim 12, the manufacturing method and electric motor which can reduce a winding man hour can be provided.

[0070]According to Claim 13 and the invention according to claim 14, the electric motor which can connect lead connection or a neutral point easily by small part mark without using special parts can be provided.

[0071]According to the invention according to claim 15, the small electric motor which can control the joule loss in a conductive plate can be provided.

[0072]According to Claim 16 and the invention according to claim 17, an electric motor with high insulation reliability can be provided.

[0073]According to the invention according to claim 18, the small electric motor which can reduce part mark and a working manhour can be provided.

[0074]According to the invention according to claim 19, the electric motor which raised the coil lamination factor can be acquired.

[0075]According to the invention according to claim 20, a high-output and efficient electric motor with few losses by a skin effect can be provided.

[0076]According to Claim 21 and the invention according to claim 22, the high power electric motor for low voltages in which it is small and power consumption is small can be acquired.

[0077]According to the invention according to claim 23, the compressor whose efficiency of energy use it is small and is high can be provided.

[0078]According to the invention according to claim 24, it is cheaply small and the small car air-conditioner of power consumption can be provided.

[0079]According to the invention according to claim 25, the car actuator whose efficiency it is cheaply small and is high can be provided.

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## CLAIMS

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## [Claim(s)]

[Claim 1]Conductive winding which is a quadrangle in which a section is [ a rotator and a teeth part of a stator core ] long to a diameter direction depth direction of a slot via an insulating material. An electric motor being constituted by stator in which a coil which the tip carried out multiple-times passage of the slot end by the side of a top panel of said stator core and the bottom for (it is hereafter indicated as a "rectangular wire"), and was wound one layer to a diameter direction depth direction of a slot was formed.

[Claim 2]The electric motor according to claim 1 whose length of a long side of a section of a rectangular wire of less than the diameter direction depth of a slot is more than half of the diameter direction depth.

[Claim 3]The electric motor according to claim 1 or 2 whose shorter side of a section of a rectangular wire is the 1/5 or less length of a long side.

[Claim 4]An electric motor given in any 1 paragraph of Claim 1 to Claim 3 which becomes large gradually as the length of a long side of a section of a rectangular wire is small the start of a volume and approaches in the end of a volume.

[Claim 5]The electric motor according to claim 1 which is an approximately trapezoid from which a section of a rectangular wire becomes broad gradually toward a diameter direction depth direction of a slot.

[Claim 6]An electric motor given in any 1 paragraph of Claim 1 closing a line which forms a body in an end at volume the beginning of a rectangular wire which forms a coil, and connects the lead end of line or neutral points to said body to Claim 5.

[Claim 7]The electric motor according to claim 6 providing an insulating material between a body (after a caulking) and a stator core which were formed in an end at volume the beginning of a rectangular wire which forms a coil.

[Claim 8]An electric motor given in any 1 paragraph of Claim 1 providing a crevice which uses as an insulator an insulation of a coil end and a stator core including a body (after a caulking) formed in an end at volume the beginning of a rectangular wire which forms a coil, and stores said body to said insulator to Claim 7.

[Claim 9]Claim 7 providing a slot or a level difference (it is only hereafter indicated as a "level difference") which stores an insulator which stored a body (after a caulking) formed in an end at volume the beginning of a rectangular wire which forms a coil, or said body in a stator core, or the electric motor according to claim 8.

[Claim 10]An electric motor given in any 1 paragraph of Claim 1 closing a line which forms a body in a volume finish end part of a rectangular wire which forms a coil, and connects neutral points or the lead end of line to said body to Claim 9.

[Claim 11]A manufacturing method of Claim 6, wherein a body of a volume start [ of a rectangular wire which forms a coil ] or start [ of a volume ], and volume finish end part is formed before winding to the electric motor according to claim 10.

[Claim 12]An electric motor given in any 1 paragraph of Claim 6 having inserted in one electric wire for neutral point connection a body and an insulating tube which were formed in a volume finish end part of a rectangular wire which forms a coil in neutral point connection, and covering an electric wire for neutral point connection except a caulking part to Claim 10.

[Claim 13]An electric motor given in any 1 paragraph of Claim 1 which connected a part or the end part of a volume with a conductive plate at volume the beginning of every [ n coils (n is two or more integers) in phase ] when three-phase-circuit connection of the coil was made and the

number in the volume start of said coil or the end of a volume was made into a 3n piece to Claim 5.

[Claim 14] An electric motor given in any 1 paragraph of Claim 1 which connected the volume start of n pieces, or the end of a volume with a conductive plate when it was considered as the n number in the volume start of a coil, or the end of a volume to Claim 5.

[Claim 15] Claim 13 using a conductive plate as copper and a copper alloy (it is only hereafter indicated as "copper"), or the electric motor according to claim 14.

[Claim 16] An electric motor given in any 1 paragraph of Claim 13 securing electric insulation between conductive plates by an insulating means provided in said conductive plate surface to Claim 15.

[Claim 17] The electric motor according to claim 16 which provided an insulation sheet, an electric insulating plate, a resin-molding article, or insulating film processing as an insulating means.

[Claim 18] An electric motor given in any 1 paragraph of Claim 13 using said conductive plate as a power supply receipt means to Claim 17.

[Claim 19] Claim 10 from Claim 1, wherein a stator core is divided into a stator core piece currently formed of at least one teeth and yoke, and an electric motor given in any 1 paragraph of Claim 12 to Claim 18.

[Claim 20] An electric motor given in any 1 paragraph of Claim 10 from Claim 1, and Claim 12 to Claim 19 whose cross-section area of a rectangular wire is more than 5 mm<sup>2</sup>.

[Claim 21] Claim 10 from Claim 1 which drives a battery which both moves as a power supply, and an electric motor given in any 1 paragraph of Claim 12 to Claim 20.

[Claim 22] An electric motor given in any 1 paragraph of Claim 10 from Claim 1, and Claim 12 to Claim 21 whose voltage which requires current which flows into a coil of an electric motor between more than 50A or a terminal of a coil is less than 50V.

[Claim 23] A compressor which carries an electric motor of a description in any 1 paragraph of Claim 10 and Claim 12 to Claim 22 from Claim 1.

[Claim 24] A car air-conditioner carrying the compressor according to claim 23.

[Claim 25] A car actuator which carries an electric motor of a description in any 1 paragraph of Claim 10 and Claim 12 to Claim 22 from Claim 1.

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[Translation done.]

## \* NOTICES \*

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] The top view of the electric motor in one working example of this invention

[Drawing 2] The top view of the electric motor in one working example of this invention

[Drawing 3] The top view of the electric motor in one working example of this invention

[Drawing 4] The perspective view of the end of a rectangular wire, and lead wire connection which forms the coil in one working example of this invention

[Drawing 5] The body formed in the end at volume the beginning of the rectangular wire which forms the coil in one working example of this invention, an insulator, and the perspective view of the axial end of a stator core

[Drawing 6] The perspective view of the electric wire for connection of the body formed in the volume finish end part of the rectangular wire in one working example of this invention, and neutral points

[Drawing 7] (a), (b), and (c) are the end connection processing perspective views of the coil in one working example of this invention.

[Drawing 8] The perspective view of the lead of the conventional electric motor, and conductive winding

[Description of Notations]

11, 21, and 31 Stator

12, 22, 32, and 54 Teeth

13, 23, 33, and 55 Slot

14, 24, and 34 Insulating material

15, 25, 35, and 62 Rectangular wire

16 and 63 Body

17, 27, 37, and 51 Stator core

41 Lead

52 Level difference

53 Insulator

61 The electric wire for neutral point connection

71 Coil

72 Start part of a volume

73 and 76 Conductive plate

74 Insulating means

75 The end part of a volume

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[Translation done.]